

**COST ESTIMATE FOR CLEANUP REPORT
FOR
PLACE BRIDGE ELEMENTARY SCHOOL
1400 SOUTH ONEIDA STREET
DENVER, DENVER COUNTY, COLORADO
SECOND REVISION**

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY
1595 WYNKOOP ST.
DENVER, COLORADO 80202

Prepared by:

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U.S. EPA Work Assignment Manager	Tim Rehder

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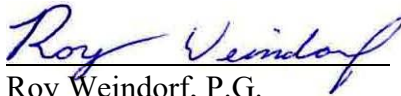
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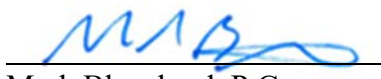
January 2018

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LIST OF ACRONYMS

bgs	below ground surface
COC	contaminant of concern
CY	cubic yard
EPA	United States Environmental Protection Agency
ESA	Environmental Site Assessment
ft bgs	feet below ground surface
QA/QC	quality assurance/quality control
RSL	Regional Screening Level
sq. ft.	square feet
START	Superfund Technical Assessment and Response Team
TDD	Technical Direction Document
WESTON	Weston Solutions, Inc.

1.0 INTRODUCTION AND PURPOSE

The United States Environmental Protection Agency (EPA) tasked the Weston Solutions, Inc. (WESTON) Superfund Technical Assessment and Response Team (START) to assist the EPA in conducting a Phase II Environmental Site Assessment (ESA) and cost estimate for cleanup at the property located at 1400 S. Oneida St. in Denver, Colorado (Site). The Phase II ESA report, *Phase II Environmental Site Assessment for 1400 S. Oneida St., Denver, Colorado* (WESTON, 2018), details the work performed, methods used, information and data acquired, and evaluation and interpretation of results as part of the Phase II ESA. This cost estimate for cleanup report is based upon the information presented in the Phase II ESA report. This cost estimate assumes that the Site will be redeveloped with single family-residential homes.

Based upon the results of the Phase II ESA conducted, the specific concerns addressed in this conceptual cost estimate for cleanup at the Site include:

- **Option #1:** Establish institutional and/or engineering controls to restrict intrusion into the “landfill footprint” and limit redevelopment to the remainder of the property.
- **Option #2:** Removal and disposal of landfill material within the “landfill footprint” and engineered contaminant migration control.

1.1 Summary of Phase II ESA Results

The Phase II ESA was conducted in accordance with Technical Direction Document (TDD) 0003/1804-06 (EPA, 2018) and ASTM International *E1903-11 – Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process*. The results of the Phase II ESA confirmed the presence of contaminants of concern (COCs) at the Site. The following list is a summary of the conclusions regarding COCs and associated media identified by START at the Site during the Phase II ESA.

Landfill Area

Based on EM survey findings and soil core observations the main landfill area extends to the east of the solar electric area. The remainder of the site also contains disperse debris and fill material.

Soils

Two VOCs, 17 SVOCs, and seven metals were detected in one or more of the 13 soil samples submitted for analysis. With the exception of arsenic, the concentrations of detected COCs were reported below the screening levels.

Upon further investigation into background levels of arsenic in soil in the United States, the mean concentration/background level is 7.2 milligrams per kilogram (mg/kg) and the mean concentration/background level for the middle and western portion of the United States (west of the 96th Meridian) is 7.0 mg/kg (USGS, 1984). Based upon these background levels, the arsenic

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concentration in samples collected from PB-BH-02, PB-BH-10, and PB-BH-13 are within background levels; however, arsenic concentrations in samples collected from PB-BH-04 are above background.

11 COCs with elevated detection limits greater than screening levels were not detected in any of the samples collected at the Site. As a result VOCs and SVOCs are not considered COCs for soils at the Site.

Arsenic is considered a COC for soils at the Site.

Groundwater

Three VOCs and four metals were detected in one or more of the six groundwater samples submitted for analysis. With the exception of arsenic, the concentrations of detected COCs were reported below the screening levels.

39 compounds with elevated detection limits greater than the screening levels were not detected in any of the samples collected at the Site. As a result VOCs and SVOCs are not considered COCs for groundwater at the Site.

Arsenic is considered a COC for groundwater at the Site.

Soil Gas

52 VOCs and methane were detected in one or more of the four soil gas samples submitted for analysis. With the exception of sample PB-SG-11 (collected within the landfill footprint), the concentrations of detected COCs were reported below screening levels.

13 COCs with elevated detection limits greater than the screening levels were not detected in any of the samples collected at the Site.

VOCs and methane are considered COCs within the landfill footprint at the Site.

1.2 Cleanup Goals and Remediation Methods

The overall purpose of cleanup at the Site is to bring the property into environmental compliance prior to or during future development. The cleanup goal(s) for the Site are listed below.

- Remove and dispose of COCs prior to or during redevelopment of the property;
- Conduct cleanup operations that are compliant with applicable local, state and federal standards and will protect human health and the environment; and
- Implement cleanup alternative(s) that are practical and effective in mitigating COCs to protect human health and the environment in both the short-term and long-term.

In order to achieve the cleanup goal(s) for the Site, the remediation methods selected for each area in this cost estimate are:

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- Conduct background metals study.
- Remove and stockpile cover soil utilizing an excavator, remove and stockpile landfill material, properly dispose of materials, and backfill excavation.
- Install slurry wall around in place landfill area.
- Conduct asbestos oversight and ACM sampling of suspect excavated material.

These remediation methods were selected based upon their overall compliance with local, state, and/or federal regulations, effectiveness in protecting human health and the environment in both the short-term and long-term, feasibility of implementation, and cost effectiveness. In addition, these methods will greatly reduce and/or permanently mitigate the COCs. Based upon the results of the Phase II ESA including COC(s) identified and plans for redevelopment, the following items of note are relevant to the remediation of the Site addressed in this cleanup report:

- For cost estimation purposes, the volumetric extent of material to be addressed by excavation is 150 ft. north/south, 325 ft. east/west and 15ft. deep (the top 3 ft. is assumed to be cover soil therefore 12 vertical ft. is assumed for disposal). This is based upon the area of elevated conductivity response (Figure 2 “Landfill Footprint”) and approximate depth of excavation at similar sites in the area.
- The cost estimate also assumes disposal as nonhazardous material at the Waste Management - Denver Arapahoe Disposal Site (DADS) Landfill and back loading of fill soil from the same.
- The cost estimate also assumes trenched material will be utilized for backfill.
- Option 1 may require additional state and local approvals and will not permanently mitigate the COCs

This conceptual cost estimate for cleanup is based upon the scope of work presented above and does not include any subsequent excavation due to confirmation sample results above comparison standards. Actual costs may change based upon the remedial approach designed in an approved remedial action plan for the Site and/or conditions encountered during the remediation activities.

2.0 COST ESTIMATES FOR CLEANUP

Presented below are the conceptual costs (not intended for budgetary estimates) to remediate the COC(s) at the Site. Conceptual costs were determined based upon information obtained from *RS Means Building Construction Cost Data 2018* (RS Means, 2018) and/or past experiences on similar projects. Actual bids from companies to perform the work may vary from this estimate depending on local conditions and other factors outside of the assessor's knowledge. Final design specifications, features, and cost of the actual remedy may differ from the conceptual design presented. A detailed cost estimate breakdown for option #2 is presented on Table 1.

Two options have been evaluated:

- **Option #1:** Establish institutional and/or engineering controls to restrict intrusion into the “landfill footprint” and limit redevelopment to the remainder of the property.
- **Option #2:** Removal and disposal of landfill material within the “landfill footprint” and engineered contaminant migration control.

2.1 Soil Excavation

Based upon the vertical and horizontal extent of materials determined by the EM Survey, the following table shows the estimated volumes of soil to be excavated at the Site.

Length (north/south)	Width (east/west)	Depth (excluding top soil)	Volume
150 ft. / 50 yd.	325 ft. / 108 yd.	12 ft. / 4 yd.	585,000 cu. ft. / 21,667 cu. yd.

Note: The approximate vertical and horizontal extents of soil to be removed are estimates based upon results from the sampling strategy implemented in the Phase II ESA. Additional assessment during the remediation stage could be conducted to further refine/delineate the actual vertical and horizontal extent of soil contamination that needs to be removed.

2.2 Slurry Wall

Volumes and cost are based upon the perimeter of the solar farm, the vertical depth below groundwater (30 ft.), and the vertical depth to bedrock (49.5 ft.). The following table shows the estimated volumes of soil to be excavated at the Site or grout to be injected if extended to bedrock.

Length	Width	Depth (excluding top soil)	Area (length by depth)	Volume
1050 ft. / 350 yd.	Excavator bucket / 1 yd.	30 ft. / 10 yd.	31,500 sq. ft. / 3,500 sq. yd.	94,500 cu. ft. / 3,500 cu. yd.
	Auger or Injection diameter / 1 yd.	50 ft. / 16.7 yd.	52,500 sq. ft. / 5,845 sq. yd.	157,500 cu. ft. / 5,845 cu. yd.

Cost for installation of a slurry wall to 30 ft. deep (below groundwater) are provided using RS Means as standard construction practice. If a slurry wall is to be installed to bedrock (50 ft. deep)

a specialty contractor is required and RS Means cannot be used for estimating purposes. Two studies are referenced for cost estimate purpose (PSU, 2017 and TCEQ, 2009). Cost estimates for various technologies are as follows:

Technology	Source	Rig / Mobilization Cost	Grout / Installation Cost	Total Cost for 5,845 sq. yd. Installed
Jet Grouting	PSU	\$35,000	\$320 per cu yd (\$617,000 using 1 ft. diameter)	\$652,232
In Situ Soil Mixing	PSU	\$100,000	\$150 per cu. yd. (\$289,328 using 1 ft. diameter)	\$389,328
Unspecified	TCEQ	Included	\$88.47 per sq. yd.	\$517,107
Unspecified Quote from Envirocon (Missoula, MT)	TCEQ	Included	\$135-\$180 per sq. yd.	\$789,075-\$1,052,100

2.3 Transportation, Disposal, and Backfill

Upon removal, 18 cubic yard trucks will transport materials to the DADS landfill where they will be loaded with backfill soil and return to the site. Each round trip is expected to be 25 miles and require 1.5 hours to complete.

2.4 Background Metals Sampling and ACM Oversight

An environmental consultant should be contracted to design and conduct sampling and excavation oversight.

2.5 Cost Estimate for Cleanup Total

It is estimated that remediation of the Site will cost approximately **\$1,045,944.91**. Additional assessment during the remediation stage could be conducted to further refine/delineate the actual vertical and horizontal extent of soil contamination that needs to be removed. Additional assessment could increase the cost of sampling; however, refinement of the extent of soil removal may significantly reduce the cost of soil excavation and disposal. The cost estimate for the tasks to be completed as presented in this cost estimate is shown in the following table:

Remediation Task	Remediation Cost
Background Soil Sampling	\$5,400.00
Excavation and Disposal	\$859,050.91
Trenching and Backfill to Groundwater (Recommended Slurry Wall Design)	\$161,094.00
Asbestos Oversight	\$20,400.00
Option #2: Total	\$1,045,944.91

These values are estimates to complete the remediation tasks and include a 20% contingency. A detailed cost estimate breakdown is presented on Table 1.

Note: Option #1 is not associated with any cost but limits the total area for development and will require negotiation with state and local stakeholders.

3.0 REFERENCES

EPA, 2018. Technical Direction Document (TDD) 0003/1804-06.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
EPA, 2018	Guidance	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Penn State (PSU), 2017, *Containment and Groundwater Modification*. Accessed at: https://www.ems.psu.edu/~elsworth/courses/geoe408/cm/remediation/2017_3_containment.pdf

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
PSU, 2017	Presentation	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

RS Means Building Construction Cost Data 2018, RS Means, 2018.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
RS Means, 2018	Guidance	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

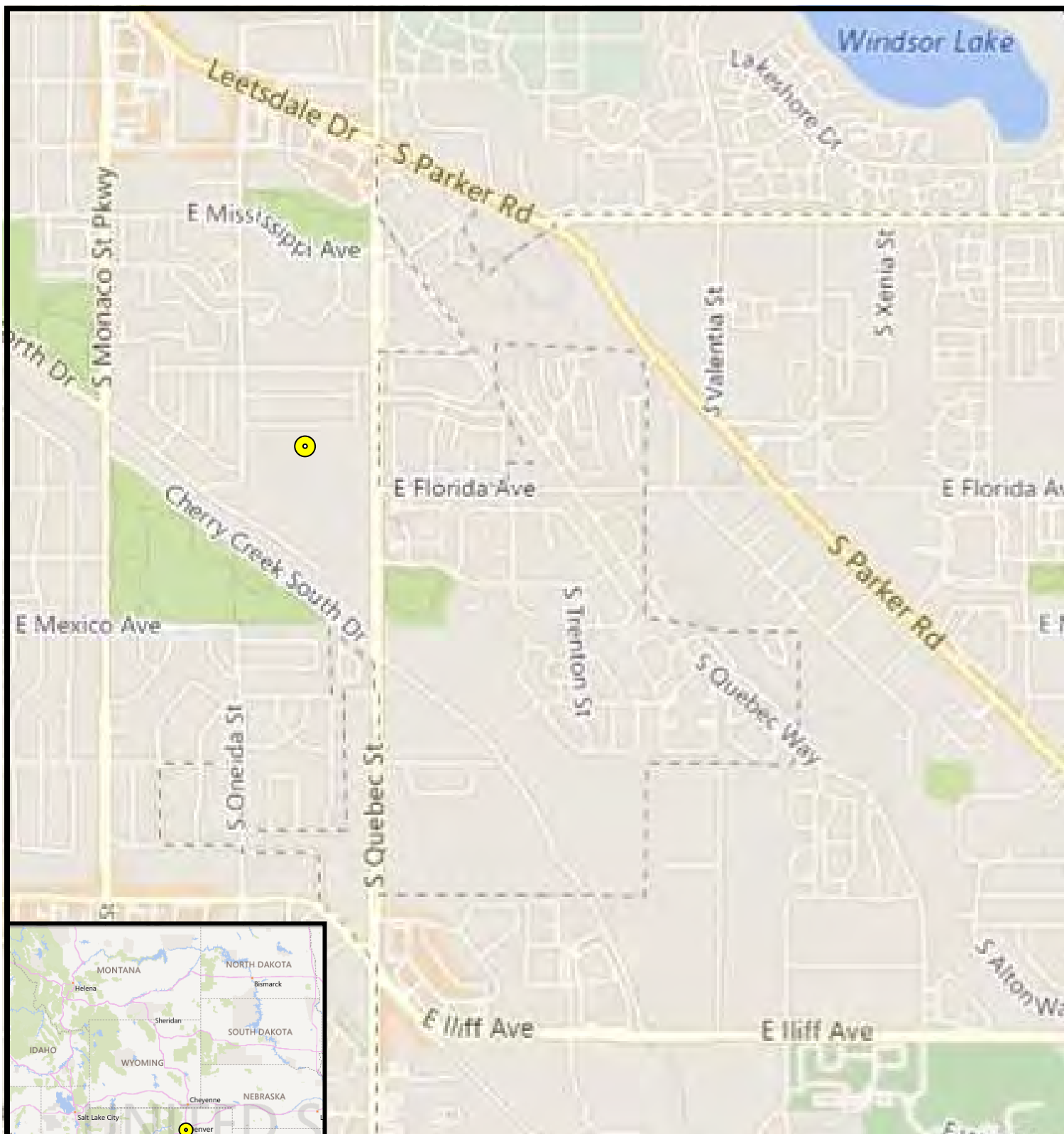
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ), 2009, *ESTIMATION OF COSTS TO PERFORM CLEANUP AT THE ASARCO EL PASO SMELTER*. April, 2009

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
TCEQ, 2009	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Weston Solutions, Inc. (WESTON), 2018. *Phase II Environmental Site Assessment for 1400 S. Oneida St., Denver, Denver County, Colorado*. August, 2018.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
WESTON, 2018	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

FIGURES



The map image is sourced from Esri for use by EPA with permission. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere. Projection: Mercator Auxiliary Sphere. Datum: WGS 1984.

Legend

● Site Location

0 650 1,300 feet



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U.S. EPA Region 8



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TDD:
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TO:
0003



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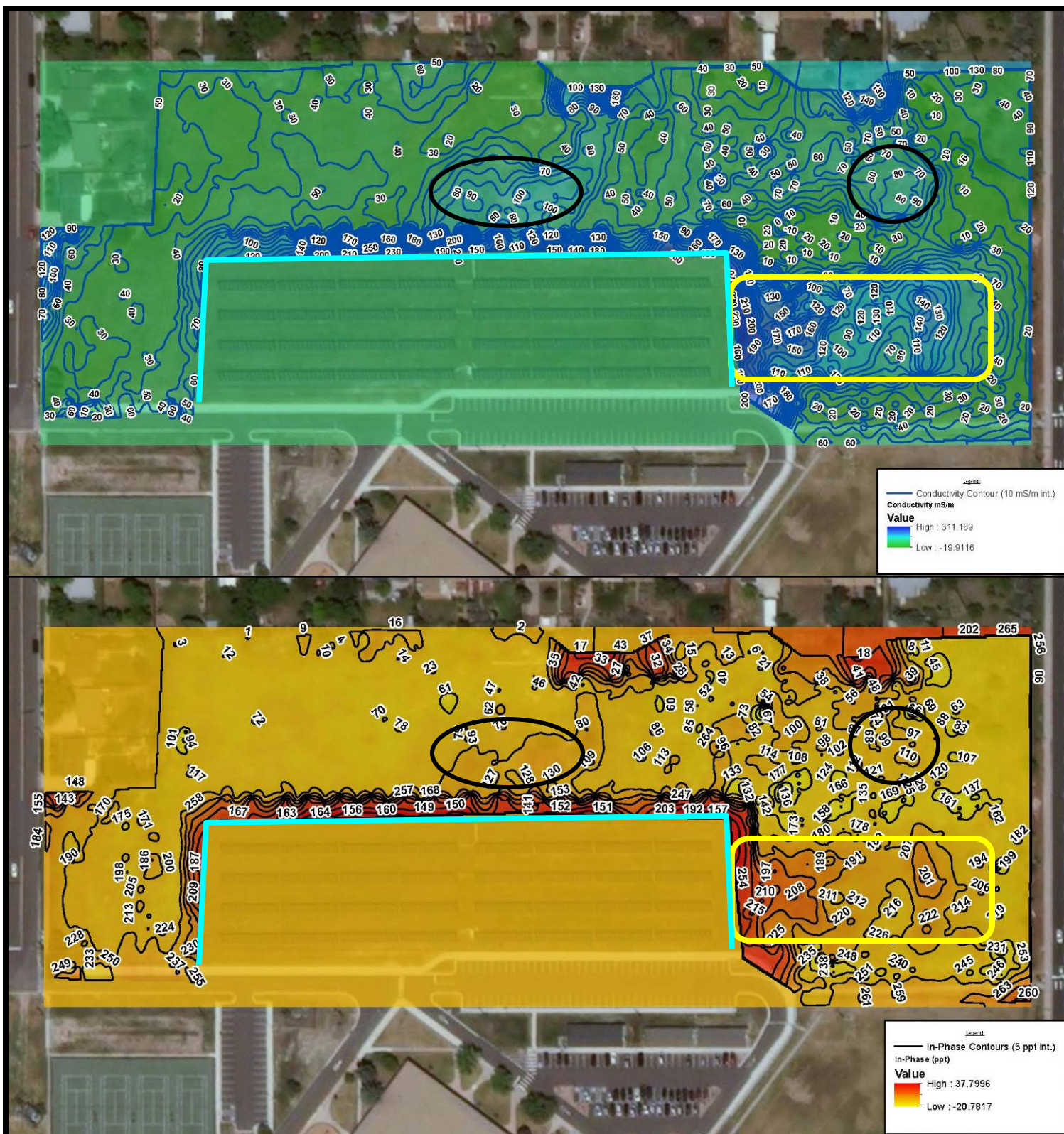
FIGURE 1

SITE LOCATION MAP

PLACE BRIDGE ELEMENTARY

**1400 SOUTH ONEIDA STREET
DENVER, DENVER COUNTY,
COLORADO**

DATE: 5/25/2018



The map image is sourced from Esri for use by EPA with permission. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere. Projection: Mercator Auxiliary Sphere. Datum: WGS 1984.

Legend

- Anomalies
- Landfill Footprint
- Slurry Wall Perimeter

0 150 300 feet



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FIGURE 2

ELECTROMAGNETIC RESULTS MAP PLACE BRIDGE ELEMENTARY

1400 SOUTH ONEIDA STREET
DENVER, DENVER COUNTY,
COLORADO

DATE: 9/28/2018

TABLES

TABLE 1
COST ESTIMATE
EXCAVATION, DISPOSAL, AND CONFIRMATION SAMPLING

Line Item (RS Means)	Item Description	Quantity	Unit	Crew	Daily Output	Hours	Factor	Unit Costs In Dollars			Total	Total with O&P	Item Total
Background Soil Sampling													
Estimation	Sampling Planning/Reporting	1	EA									2000	\$2,000.00
Estimation	Sampling Event	1	EA									1500	\$1,500.00
Estimation	Laboratory Results (10 Samples)	10	EA									100	\$1,000.00
01.21.16.50.0020	Contingency (20%)												\$900.00
	Background Soil Sampling												\$5,400.00
Excavation and Disposal													
01.54.36.50	Mobilization/Demobilization	1	EA	--	--	--	1	--	--	--	1225	1350	\$1,350.00
31 .23.16.42.0300	Soil Stripping and Stockpiling By Dozer (Factor times 6 for depth)	1806	SY	B-10B	4000	0.003	6	--	0.15	0.32	0.47	0.57	\$6,175.00
31 .23.16.42.0300	Excavating with Excavator Crawler Mounted 3 CY Capacity (1/2 production for debris)	21667	BCY	B-12D	2080	0.008	0.5	--	0.37	1.06	1.43	1.72	\$18,633.33
Estimate	TCLP Sampling	1	EA									1000	\$1,000.00
31.23.23.20.9704	Hauling 18 CY Truck, 2x 30 min wait/ld/unload, 45 MPH, 25 mile cycle	21667	LCY	B-34L	108	0.074	1	--	3.83	7.36	11.19	13.87	\$300,516.67
02.41.16.15.0500	Disposal Fees	21667	CY	B-3	445	0.108	1	--	--	--	10.25	10.25	\$222,086.75
Quote	Fill Material	21667	LCY	B-15	1200	0.23	1	--	--	--	5	5	\$108,335.00
On-Site Material	Fill Material	-6000	LCY	B-15	1200	0.23	1	--	--	--	5	5	-\$30,000.00
31.23.23.13.1700	Dozer Backfilling, compaction with sheepsfoot roller	23473	LCY	B-10D	650	0.018	1	--	0.79	2.27	3.06	3.68	\$86,379.00
31.22.13.20.0170	Rough Site Grading by Dozer	1	EA	B-10L	1	12	1	--	590	\$465.00	1055	1400	\$1,400.00
01.21.16.50.0020	Contingency (20%)												\$143,175.16
	Excavation and Disposal												\$859,050.91
Trenching and Backfill													
01.54.36.50	Mobilization/Demobilization	1	EA	--	--	--	1	--	--	--	1225	1350	\$1,350.00
31 .23.16.13.7320	Excavating, Trench 20 - 24 ft Deep, 2-1/2 CY excavator	3500	BCY	B-12S	605	0.026	1	--	1.27	2.33	3.6	4.49	\$15,715.00
31.23.23.16.0035	Fill Material (Select Fill)	3500	LCY	B-15	1200	0.23	1	20	1.1	1.97	23.07	27	\$94,500.00
31.23.23.13.1900	Dozer Backfilling, trench	3500	LCY	B-10B	900	0.013	1	--	0.65	1.41	2.06	2.55	\$8,925.00
31.23.23.13.2200	Compaction 6 - 12" lifts, Vibrating Plate Roller	3500	LCY	B-10C	700	0.017	1	--	0.84	\$2.42	3.26	3.93	\$13,755.00
01.21.16.50.0020	Contingency (20%)												\$26,849.00
	Trenching and Backfill												\$161,094.00
Asbestos Oversight													
Estimation	3rd Party Oversight for Asbestos Cleanup (1 Inspector / 2 Weeks)	80	Hour	1 Inspector	10	1	1	--	150	--	150	200	\$16,000.00
Estimation	ACM Sampling	20	EA	--	--	--	1	--	--	--	--	50	\$1,000.00
01.21.16.50.0020	Contingency (20%)												\$3,400.00
	Building Demolition Total												\$20,400.00
ACM, LBP/LEAD-IN-SOIL, AND BUILDING DEMOLITION TOTAL													\$1,045,944.91

Notes:
Source: RS Means Building Construction Cost Data 2017. 76th Annual Edition. Catalog # 60018
Disclaimer: This is only an estimate, actual costs may vary
ACM Asbestos Containing Materials
CY Cubic yards
EA Each
Equip Equipment
LF Linear feet
Mtrls Materials
N/A, -- Not Applicable
O&P Overhead and Profit
SF Square feet
* Converted Cost Per Mile to Cost per CY using factor (Based on 25 mile round trip)